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FEED-IN TARIFF FOR SOLAR PHOTOVOLTAIC: MONEY FROM THE SUN?

by

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INTRODUCTION

Climate change is the greatest ‘market failure’ the world has seen. This has stimulated policy makers around the world to turn into renewable energy. As a result, renewable energy is indeed the order of the day and the sun is the most powerful source of energy that God has blessed mankind with. This is a natural resource, freely available and will be replenished as long as the sun shines. The sunlight, or solar energy, can be used for heating, lighting and cooling homes and other buildings, as well as for generating electricity, water heating, and a variety of industrial processes. The importance of solar energy is reflected in the following statements of the Prime Minister of India, Dr. Manmohan Singh:⁶

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⁶ Dr Manmohan Singh, Prime Minister of India, launching India's National Action Plan on Climate Change on June 30, 2008.

Over a period of time, we must pioneer a graduated shift from economic activity based on fossil fuels to one based on non-fossil fuels and from reliance on non-renewable and depleting sources of energy to renewable sources of energy. In this strategy, the Sun occupies centre-stage, as it should, being literally the original source of all energy.

Although renewable energy and solar power are not the panacea to the world's problem of climate change, there is no doubt that they play a major role in the global energy supply and help to mitigate climate change. In this regard, Feed-in Tariffs ('FiTs') have become the most important driving force behind many renewable energy deployments, globally. Feed-in Tariffs work because they are more equitable than other policies. They enable everyone — including individuals, homeowners, organisations, communities and businesses, who have not traditionally engaged in the electricity generation — to profit from the renewable energy market.

This paper examines the FiTs in relation to renewable energy, specifically solar photovoltaic ('PV') in Malaysia. It investigates whether the recently introduced FiTs, through the enactment of the Renewable Energy Act 2011, would persuade Malaysian households to take advantage of the scheme. The paper analyses whether house owners would eventually shift to PV to power their houses and invest their money on that and be rewarded at the same time.

FEED-IN TARIFFS: WHAT, WHY AND SUCCESS STORIES

A FiT is a payment for energy. It was first introduced in Germany in 1991 under the 'Electricity Feed Law' and revised under the 'Renewable Energy Law' in 2000. As of 2011, FiTs policies have been enacted in over 50 countries around the world. There is no standard, official, definition of 'Feed-in Tariff.' The U.S National Renewable Energy Laboratory ('NREL') defines FiTs as a legal document which obligates an electric distribution utility to purchase electricity from an eligible renewable energy seller at specified prices (set sufficiently high to attract the state to the types and quantities of renewable energy desired by the state) for a specified duration; and which, conversely, entitles the seller to sell to the utility, at those prices for that duration, without the seller needing to obtain additional regulatory permission.⁷ In the similar vein, the Ministry of Energy, Green Technology and Water of Malaysia states that: "FiTs oblige distribution licensees to buy from feed-in approval holders

⁷ *National Renewable Energy Laboratory, Renewable Energy Prices in State-Level Feed-in Tariffs: Federal Law Constraints and Possible Solutions* (2011), at p. v.

the electricity produced from renewable sources and set the FiTs rate.”⁸ The European Union Environmental Agency defines the FiT as the price per unit of electricity that a utility or supplier has to pay for renewable electricity from private generators. The United Kingdom (UK) Department of Energy and Climate describes FiTs as a “clean energy cashback” for householders, communities and businesses – which allow them to become the generators of electricity, as opposed to simply consumers.⁹

Also known as 'advanced renewable tariffs' ('ARTs') or 'renewable energy payments' ('REPs'), the FiTs schemes basically pay renewable energy producers a set rate (tariff) for each unit of electricity fed into the grid, and generally oblige the power companies to purchase all the electricity from eligible producers in their service area over a long period of time - usually 15 to 20 years. The feed-in policies in some countries comprise a range of renewable energy technologies while in other countries, they cover only one or two technologies. Tariffs are often differentiated according to the technology types, sites/location of power generation, year of operation, and season of the year.¹⁰

In the UK, Ireland, France and Norway, FiTs are set through competitive bidding. The scheme is popular with the European countries, including Austria, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Latvia, Lithuania, Portugal, Slovak Republic, Slovenia, Spain and Sweden.¹¹ The European FiTs have stimulated investments in wind power, biomass, small-scale hydro, PV and solar thermal power generation.¹² In the United States of America (US), premiums were paid for electricity from the renewable energy sources through the Federal Production Tax Credit ('PTC'). The PTC was initially designed for wind power and 'closed-loop' biomass systems and later extended to include geothermal, solar, bio-energy, municipal solid waste energy and small renewable energy project for irrigation.¹³

Currently, FiTs are the most widely used policy in the world for accelerating renewable energy deployment. They have generated significant renewable

⁸ See the Ministry of Energy, Green Technology and Water, *Handbook on the Malaysian Feed-in Tariff for the Promotion of Renewable Energy* (2011), at p. 9.

⁹ Department of Energy and Climate Change, *Feed-in Tariffs Government's Response to the Summer 2009 Consultation* (2010), at p. 5, available at <http://www.FiTariffs.co.uk/library/regulation/100201FinalDesign.pdf>.

¹⁰ The United Nations Environment Programme (UNEP), *Changing Climate: The Role of Renewable Energy in a Carbon-Constrained World* (2006), at p. 15.

¹¹ *Ibid.*

¹² *Ibid.*

¹³ *Ibid.*

energy deployment, helping bring the countries that have implemented them successfully to the forefront of the global renewable energy industry.¹⁴ In Europe, the countries using FiTs have been responsible for the majority of newly installed wind onshore and PV capacity: 86% of all wind onshore capacity and nearly 100% of all PV capacity installed by the end of 2009 were initiated by FiT systems.¹⁵ Also in overall terms, those countries using the FiTs have had a leading role in developing renewables energy: 77% of the new renewable electricity generation in Europe installed between 1997 and 2008 was contributed by these countries.¹⁶

The positive impact of a FiT on wind energy deployment is demonstrated by best-practice countries, particularly Spain, Germany, Denmark and Portugal. In total, the installed wind power capacity in Europe has increased by a factor of almost eight from 1999 to 2009 and risen from 9,678MW to 74,767MW. From 2008 - 2009, the growth in the wind energy capacity was 16%.¹⁷

With regard to solar energy, in most European countries with significant PV deployment, the vast majority of installations have occurred following the introduction of a feed-in scheme. The strong growth in Germany and formerly Spain are the clearest indicators, but also recent tariff introductions in Italy, France, Portugal, Czech Republic and Slovenia have led to the stimulation of previously insignificant markets for PV.¹⁸ The FiTs policies have led to the deployment of more than 15,000MW of solar photovoltaic power and more than 55,000MW of wind power between 2000 and the end of 2009 in Europe. Globally in total, FiTs are responsible for approximately 75% of global PV and 45% of global wind deployment.¹⁹

The 2008 document of the European Commission states that: "This report presents an updated review of the performance of the support schemes using the same indicators presented in the 2005 report. It finds that, as in 2005, *well-adapted* feed-in tariff regimes are generally the most efficient and effective

¹⁴ National Renewable Energy Laboratory of the U.S Department of Energy, *A Policymaker's Guide to Feed-in Tariff Policy Design* (2010), at p. v.

¹⁵ Fraunhofer ISI, Energy Economic Groups and Ecofys, *Recent Experiences with Feed-in Tariff Systems in the EU – A Research Paper for the International Feed-in Cooperation* (2010), at p. 7.

¹⁶ *Ibid.*

¹⁷ *Ibid.*

¹⁸ *Ibid.*

¹⁹ *Ibid.*

support schemes for promoting renewable electricity.”²⁰ Similarly, the International Energy Agency states that: “... So far, the technology-specific support schemes such as well-designed feed-in tariffs correctly tuning incentives, providing a long-term predictability of support and being applied in an appropriate policy framework properly addressing noneconomic barriers, have proven to be both effective and cost-efficient.”²¹ The worldwide assessment by the Deutsche Bank in addition, reports that:²²

Feed-in tariffs continue to be the driving force behind many renewable energy deployments globally, and are an effective policy tool for catalysing the large investment flows needed to achieve 2020 emissions reduction targets and clean energy mandates. European countries continue to lead the way in creating the transparency, certainty and longevity needed to attract sustainable capital investment, although the momentum has spread to Asia, Canadian provinces and some US states and municipalities.

Specifically for PV in Germany, the Deutsche Bank 2011 Report states that: ‘Through our global analysis of international climate and energy policy, we singled out Germany’s feed-in tariff (FiT) for renewable electricity as the ‘best in class’ for minimizing investor’s risk and cost-effectively scaling up renewable generation. Germany’s advanced FiT maximizes investor’s transparency, longevity and certainty while charting a pathway to grid parity within an overall cost/benefit framework.’²³ The installed PV capacity increased from 1,910MW in 2005 to 6,019MW in 2008 and 9,830MW in 2009.²⁴ The renewable energy industry employed 340,000 people, and out of these, 64,700 were created by the PV industry alone.²⁵

The UK’s Coalition Government introduced the FiT policy on 1 April 2010. The renewable sources eligible for the scheme are the small hydro-electricity, PV, wind turbine, micro combined heat and power (‘micro CHP’) and anaerobic digestion. By 17 June 2011, 42,143 installations had been

²⁰ Commission Staff Working Document: *The Support of Electricity from Renewable Energy Sources* - Accompanying Document to the Proposal for a Directive Of The European Parliament And Of The Council On The Promotion Of The Use Of Energy From Renewable Sources, available at http://ec.europa.eu/energy/climate_actions/doc/2008_res_working_document_en.pdf.

²¹ International Energy Agency, *Deploying Renewables: Principles for Effective Policies* (2008), at pp 175-176.

²² See the U.S *National Renewable Energy Laboratory* report available at <http://www.nrel.gov/docs/fy10osti/44849.pdf>.

²³ Deutsch Bank Group, *The German Feed-in Tariff for PV: Managing Volume Success with Price Response* (2011), at p. 3.

²⁴ *Supra* n. 10 at p. 8.

²⁵ *Supra* n. 18 at p. 6.

registered to participate in the scheme.²⁶ Out of these, 30,263 installed renewable installations were registered within the first year of the scheme from 1 April to 31 March 2011 and this represented 108.5MW of total installed capacity.²⁷ A total of £4,714,129.01 of FiT payments was due to the generators. The PV installations dominated the total number of registered installations - over 96% of all installations registered between 1 January and 31 March 2011.²⁸ The vast majority of installations are by the households. In terms of the amount of PV power installed, it has jumped from 26MW before the scheme started to 77.8MW at the end of March 2011.

Clearly, FiT has become the policy instrument of choice for so many diverse economies around the world. This is because FiTs are empirically proven to promote the fastest expansion of renewable electric power, at the lowest cost. They also do so more simply, transparently and democratically than other schemes.²⁹ Unlike other mechanisms, such as tax credits or research and development subsidies, FiTs do not need to cost governments anything, being usually funded through costs spread among all electric utility customers, as part of their regular bill.³⁰ They are performance-based, only paying for the actual output of the renewable electricity, not just given out as a grant for purchasing the equipment. The FiTs work so well because they are simple and inclusive, allowing all players to invest.³¹ They are more transparent than other schemes, have lower administration costs, and when designed properly — and supported by appropriate planning laws — can get deployment moving very quickly.³² Generally, FiTs also accelerate the cost reduction of renewable energy technologies, making them cost-competitive with conventional energy sources at a much faster pace.³³

IS THE SUN THE FUTURE FOR MALAYSIA?

²⁶ The U.K Office of Gas and Electricity Markets (OFGEM), Feed-in Tariff – Update, available at <http://www.ofgem.gov.uk/Sustainability/Environment/FiTs/Newsletter/Documents1/Feed-in%20Tariff%20%28FIT%29%20Update%20Newsletter%20Issue%204.pdf>.

²⁷ *Ibid.*

²⁸ *Ibid.*

²⁹ Miguel Mendonca and David Jacobs, *Feed-in Tariff Go Global: Policy in Practice, Renewable Energy World.com*, available at <http://www.renewableenergyworld.com/rea/news/article/2009/09/feed-in-tariffs-go-global-policy-in-practice>.

³⁰ *Ibid.*

³¹ *Ibid.*

³² *Ibid.*

³³ *Ibid.*

Malaysia had a total population of more than 27 million in 2010.³⁴ To date, there are approximately 6.5 million households in Malaysia with an average household size of 4.31 people.³⁵ At the moment, the residential dwellings total about 7.3 million,³⁶ and are projected to increase by about 150,000 each year.³⁷ With such a big increase in the number of residential houses, plus the growth in the commercial and industrial sectors, it is expected that the demand for electricity will also increase. In the first half of 2010 alone, 21% of the electricity generated in Malaysia was consumed by the residential sector³⁸ with an average annual consumption of 3,300kWh per household. A typical house uses more than 40% of the electricity on the fridge, air-conditioning and water heating.³⁹

The electricity generation in Malaysia is largely produced from fossil fuels, mainly from natural gas and coal, which constitute nearly 90% of the overall generation, as illustrated in Table 1.⁴⁰ It can be seen that the electricity generated in 2010 has doubled from the amount in 2000. In addition, Table 1 clearly illustrates that the electricity in Malaysia is fully dependant on fossil fuel sources. Although Malaysia is ranked 16th in terms of the size of its natural gas reserves,⁴¹ it is reported that the country could only sustain current natural gas production for about 29 years.⁴² The supply for coal, on the other hand, is imported from outside of Malaysia, mainly from Indonesia (84%), Australia

³⁴ Department of Statistics Malaysia, available at http://www.statistics.gov.my/portal/download_Population/files/BPD/population_quarter_s_2010.pdf.

³⁵ *Ibid.*

³⁶ Department of Statistics Malaysia, *Laporan Kiraan Permulaan, Banci Penduduk dan Perumahan Malaysia* (2010).

³⁷ *Real Estate and Housing Developers' Association Malaysia (REHDA), REHDA Bulletin July* (2010), at p. 7, available at <http://www.rehda.com/bulletin/10/bulletin-1007.pdf>.

³⁸ Energy Commission Malaysia, *Interim Report on the Performance of the Electricity Supply Services in Malaysia* (for the first half year of 2010), at p.8, available at http://www.st.gov.my/index.php?option=com_phocadownload&view=category&id=10%3Astatistics-electricity&download=125%3Ainterim-report-on-the-performance-of-the-electricity-supply-services-in-malaysia-for-the-first-half-year-of-2010&Itemid=4241&lang=en.

³⁹ FM Taha, *Development of Energy Labeling in Malaysia; Past, Present and Future*, APEC Seminar on Cooperation on Energy Labeling, APEC, Kaohsiung, Chinese Taipei, (2003), pp. 1-11.

⁴⁰ Economic Planning Unit 2006, Ninth Malaysia Plan 2006-2010, Economic Planning Unit, Putrajaya, Malaysia.

⁴¹ Central Intelligence Agency 2011, *The World FactBook*, available at <https://www.cia.gov/library/publications/the-world-factbook/geos/my.html>.

⁴² S Ahmad, MZAA Kadir and S Shafie, *Current Perspective of the Renewable Energy Development in Malaysia*, *Renewable and Sustainable Energy Reviews* (2011), vol 15, no 2, at pp. 897-904.

(11%) and South Africa (5%).⁴³ This means that to sustain this increasing electricity demand, while cutting the dependency on the fossil fuels, Malaysia needs to shift her electricity generation to alternative energy resources.

Table 1: Source of electricity in Malaysia⁴⁴

Year	Oil	Coal	Gas	Hydro	Other	Total (GWh)
	(%)					
2000	4.2	8.8	77.0	10.0	0.0	69,280
2005	2.2	21.8	70.2	5.5	0.3	94,299
2010	0.2	36.5	55.9	5.6	1.8	137,909

Malaysia lies in what can be called the ‘tropical solar belt’ about 30 degrees North and 30 degrees South of the Equator and therefore has a consistently good solar radiation available. With this strategic geographical location, the country benefits from a huge amount of solar insolation, ranging from 1,400 to 1,900kWh/m²,⁴⁵ averaging about 1,643kWh/m² per year⁴⁶ with approximately 10 sun hours per day.⁴⁷ As a comparison, Germany⁴⁸ and the UK⁴⁹ receive an annual solar insolation of approximately 1,000kWh/m². In Malaysia, it was calculated theoretically that 1 kWp of solar panels installed in an area of 431 km² could generate enough electricity to satisfy the electricity requirement of the country in 2005.⁵⁰ Given its potential, it is unwise not to tap into this resource for Malaysia’s benefits.

Currently, renewable energy of different forms such as biomass, biogas, mini-hydro, PV and solid waste, contributes only 43MW of generated electricity in Malaysia, which amounts to a share of 0.5%.⁵¹ The biomass accounts for half of the amount. The importance of solar energy or PV is

⁴³ AJ Jaffar, *Outlook of Coal Demand/Supply & Policy in Malaysia, Cleaner Coal: Moving Towards Zero Emissions*, APEC, Incheon, South Korea (2009).

⁴⁴ *Supra* n. 35.

⁴⁵ *Supra* n. 37.

⁴⁶ AH Haris, *MBIPV Project: Catalyzing Local PV Market*, presented at the Finance & Investment Forum on PV Technology, Kuala Lumpur, Malaysia (2008).

⁴⁷ N Amin, CW Lung and K Sopian, *A Practical Field Study of Various Solar Cells on Their Performance in Malaysia, Renewable Energy* (2009), vol 34, no 8, at pp 1939-1946.

⁴⁸ S. Hack, *International Experiences with the Promotion of Solar Water Heaters (SWH) at Household-level* (2006), at p. 12, available at http://www.conuee.gob.mx/work/sites/CONAE/resources/LocalContent/7157/1/IEPSW_H.pdf.

⁴⁹ Energy Saving Trust UK, *New and Renewable Energy Technologies for Existing Housing* (2005), at p. 12.

⁵⁰ *Supra* n.41, at p. 2.

⁵¹ Marc von der Forst, *Feed-in Tariffs in Malaysia: A Turnkey Solution to Increase the Actual Amount of Grid-connected Photovoltaic Energy?* available at www.gbp-international.com/attachments/feed_in_tariffs_in_malaysia.pdf, at p.7.

simply non-existence⁵² as the solar energy and PV has not yet being fully utilised to generate any significant amount of electricity. In spite of possessing very good overall geographic location and being the fourth largest producer of solar cells worldwide, Malaysia's level of generated grid-connected PV energy only accounts for approximately 0.0000416% of the total energy generation.⁵³

The National Renewable Energy Policy and Action Plan ('NREPAP') 2010 adopted the vision to enhance the utilisation of indigenous renewable resources to contribute towards national electricity supply security and sustainable economic development. Five objectives and strategic thrusts have been identified. Two of the objectives are to increase the contribution of renewable energy in the national power generation mix and to facilitate the growth of the renewable industry. The Prime Minister, in his speech introducing the Tenth Malaysian Plan (2011-2015) on 10 June 2010 reiterates the need for Malaysia to undertake a more strategic development of energy supply by diversifying energy sources, including renewable energy sources.⁵⁴ He acknowledges the importance of renewable energy to ensure the sustainability of the environment and the significance of FiTs to encourage the implementation of renewable energy projects.⁵⁵

Solar energy is one of the key sources of renewable energy that is being seriously pursued. Malaysia intends to increase the amount of grid connected PV from 7MW at the end of 2011 to 55-65MW in 2015 and to 190MW in 2020.⁵⁶ It is expected that the power generated by PV will increase by a rate of 3,079% by the year 2040, making it the most prosperous renewal energy in the future, far ahead of mini-hydro, biomass, biogas and solid waste.⁵⁷ The FiTs, undoubtedly, play a vital role in achieving these ambitious targets.

FEED-IN TARIFFS IN THE RENEWABLE ENERGY ACT 2011

Malaysia is convinced that FiTs is the way forward to shift to renewable energy. The 2011 document states that: 'The Ministry of Energy, Green Technology and Water has conducted a thorough study on the effectiveness of the major renewable policy instruments practiced globally. The findings of the study

⁵² *Ibid.*

⁵³ *Ibid* at p. 4.

⁵⁴ See the speech, available at http://www.pmo.gov.my/dokumenattached/speech/files/RMK10_Speech.pdf.

⁵⁵ *Ibid.*

⁵⁶ *Supra* n. 46, at p. 34.

⁵⁷ *Ibid.*

showed that FiT is the most effective renewable energy policy mechanism in promoting and sustaining renewable energy growth.”⁵⁸ The FiTs was introduced in Malaysia by Parliament passing the Renewable Energy Act 2011 (‘REA’) in April. As mentioned in the preamble to the REA, its creation is with a specific purpose, which is to establish and implement a special tariff system or FiT to catalyse the generation of renewable energy. The FiT system will be administered and implemented by the new entity called the Sustainable Energy Development Authority (‘SEDA’) created by its Act.

Before someone can benefit from the FiT, the person will have to make an application to the SEDA to be a feed-in approval holder. The threshold is 30MW. This means that a person shall be eligible to apply for the feed-in approval holder if he proposes to generate renewable energy from an installation having an installed capacity of not more than 30MW. The REA sets out the application process, the powers of the SEDA to grant or refuse the feed-in approval, conditions and additional conditions for the approval and to revoke the feed-in approval after it is granted.

If the application is successful, the distribution licensee (for e.g. Tenaga Nasional Berhad) is required under s 12(1) of the REA, to enter into a renewable energy power purchase agreement with the feed-in approval holder. When the feed-in approval holder generates and supplies electricity to the licensee, s 16 makes it mandatory for the distribution licensee to pay the feed-in approval holder based on the agreement. The money to be used to pay the feed-in approval holder will come from the Renewal Energy Fund (‘REF’) created by the REA. The REF is financed by the consumers themselves through the recently 1% increase in electricity tariff. This amount will be pooled into the REF.

The renewable energy sources that qualify for the FiT funding under the Act are biogas, biomass, small hydropower and solar PV. For the latter, the feed-in approval holder will be paid the minimum rate of RM1.23 per kWh with an installed capacity up to 4kW. The minimum rate is RM0.85 if the capacity achieve above 10MW, and up to and including 30MW. The lower rate for larger producers is based on the ‘economies of scale’ principle. Additional bonuses are also introduced on top of the basic FiT rate (ranging from RM0.01 to RM0.55 per kWh) when the installation meets specific criteria. The tariffs will be lowered each year after the introduction, by a degression factor of 8% annually. The contract period is fixed by the REA for 21 years. The REF will

⁵⁸ *Supra* n. 3 at p. 10.

be available until 2030 when it reaches a cumulative value of RM 18.9 billion. With the 8% degression rate annually, it is expected that by that year, the cost of solar electricity will reach the grid parity, driven by the environment and energy security. Grid parity occurs when the cost of generating the renewable energy is equivalent to, or is lower than the cost of generating power from conventional fossil fuel.

Like in other countries, the FiT in Malaysia which is designed to achieve grid parity, has several key features: it applies to certain renewable energy sources, degression rates, obligation of the distribution license to purchase and has maximum capacity. Worldwide studies have identified several key factors in a successful FiT policy. Firstly, stability - energy projects require several years to develop, so FiTs have to be in place for five years or longer to encourage certainty. Secondly, long-term contract – contracts in the range of 15-20 years allow investors to recover their costs. Thirdly, adequate energy prices - FiTs must cover project costs, plus a reasonable return to create stability, attract investors, lower risk and keep financing relatively simple. Fourthly, annually decreasing payments - as innovation and growth reduce technology costs, tariffs should be lowered according to a transparent and incremental plan. Fifthly, reduce bureaucracy – streamlining approvals reduces barriers and costs. Streamlining procedures especially helps small projects and encourages broader participation.

NEW INVESTMENT OPPORTUNITY?

As mentioned earlier, one of the success factors to implement the FiT is that the scheme should be able to generate a good return and reasonable profit to homeowners. It is possible to quantify the investment in solar technology. An analysis is done to compare the installation in the UK, Germany and Malaysia. To ease the calculation, a number of assumptions are made: (i) each house uses a 2.50kWp solar panel; (ii) the installation cost is paid in full at the beginning of the project – no loan is taken to fund it; (iii) the solar panel maintains a 100% performance during its contract period; (iv) the maintenance cost is 1% of the capital cost,⁵⁹ and (v) the calculation is done for the duration of contract period, i.e. 21 years for the installation in Malaysia.⁶⁰ The detail results from the calculations are presented in Table 2.

⁵⁹ International Energy Agency, *Technology Roadmaps - Solar Photovoltaic Energy* (2010), at p. 9, available at http://www.iea.org/papers/2010/pv_roadmap.pdf.

⁶⁰ F Muhammad-Sukki, R Ramirez-Iniguez, SH Abu-Bakar, SG McMeekin, BG Stewart and MV Chilukuri, *Feed-In Tariff in Malaysia: Financial Analysis and Public Perspective*, Proceedings of International Power Engineering and Optimisation Conference, (2011), at pp. 221-226.

Table 2 shows the installation cost of solar PV, total revenue earned at the end of the contract period and total profit gained from the installation for each location, together with the average annual return on investment and the payback period. The comparative analysis shows some interesting findings, which are as follows: (i) Malaysia has the highest average annual return on investment, which is 9.53%; (ii) in terms of payback period, Malaysia has the shortest reading among the three locations, with a duration of seven years, and (iii) in spite of the high capital cost in Malaysia, the homeowner could generate a total profit of about RM 95,700.35 throughout the whole contract period- the highest value as compared to the rest.

It is possible to conclude that the FiT scheme in Malaysia is lucrative and could generate a reasonable return to the homeowner. This is mainly supported by the high FiT rate as well as the high amount of solar insolation available in Malaysia. The cost of PV per kWp also plays a crucial role in reducing the capital cost, which, in return, could generate more revenue as well as attracting more people to invest in solar PV installation.

Table 2: Comparative financial analysis of solar PV installation

Item	Unit	Malaysia	United Kingdom	Germany
Average Yearly Solar Insolation	kWh/m ²	1,643	1,000	1,000
Installation cost	RM	47,800.00 ⁶¹	61,640.25 ⁶²	28,793.15 ⁶³
Electricity generated from the 2.5kWp PV panel	kWh	4,107.50	2,500.00	2,500.00
Contract Period	Year	21.00	25.00	20.00
<i>Income from the FiT Scheme</i>				

⁶¹ Malaysia Building Integrated Photovoltaic (MBIPV) Technology Application Project, available at: <http://www.mbipv.net.my/>.

⁶² Energy Saving Trust UK, *New and Renewable Energy Technologies for Existing Housing*, (2005), at p. 12, available at <http://www.energysavingtrust.org.uk/Publication-Download/?p=1&pid=652>.

⁶³ Renewables International, *Cost of Turnkey PV in Germany Drops*, (2010), available at: <http://www.renewablesinternational.net/>.

FiT rate	RM/kWh	1.78 ⁶⁴	2.18 ⁶⁵	1.66 ⁶⁶
Generation of Electricity	RM	7,311.35	5,461.33	4,158.19
Maintenance per year	RM	478.00	616.40	287.93
Annual Revenue	RM	6,833.35	4,844.92	3,870.26
Total Revenue at the end of contract year	RM	143,500.35	121,123.09	77,405.24
<i>Investment Analysis</i>				
Total profit	RM	95,700.35	59,482.84	48,612.09
Payback Period	Year	7	12.72	7.44
Average Annual Return on Investment	%	9.53	3.86	8.44

An analysis to investigate the solar investment with other investment tools that are available in Malaysia has also been conducted recently.⁶⁷ Malaysians have the opportunity to invest in unit trusts, national unit trusts, Employee Provident Fund ('EPF'), government bonds, fixed deposits and savings accounts. The findings, presented in Table 3 indicate that the solar investment could only generate performance better than the fixed deposit and savings account. From the table, it is possible to conclude that due to the lower average

⁶⁴ See the Malaysia's Renewable Energy Act 2011. The chosen FiT rate is based on the assumptions, which are: (i) any installation of a solar panel of a capacity up to 4kW will receive RM1.23 per kWh; (ii) bonus for mounting the panel of rooftop will gain RM0.26 per kWh; (iii) bonus for using the panel as part of building material will add RM0.25 per kWh; (iv) bonus for using locally manufactured or assembled solar PV modules will obtain RM0.03 per kWh, and (v) additional bonus for using a locally manufactured or assembled solar inverters will add another RM0.01 per kWh. This final sum of the FiT rate per kWh for solar PV in this calculation is RM1.78.

⁶⁵ *Supra* n.4. The chosen FiT rate is based on the assumptions which are: (i) the generation tariff of £0.413 per kWh, and (ii) the exporting tariff of £0.03 per kWh. The total FiT per kWh is £0.443. The conversion rate is £1.00 equals RM4.92.

⁶⁶ Sun+energy, *Tarifas Fotovoltaicas Europeas*, (2010), available at <http://www.sunplusenergy.com/docs/tarifasfveuropa.pdf>. The chosen FiT rate is based on the assumption that the generation of electricity tariff of €0.3957 per kWh. The conversion rate is €1.00 equals RM4.20.

⁶⁷ F Muhammad-Sukki, R Ramirez-Iniguez, SH Abu-Bakar, SG McMeekin and BG Stewart, *An Evaluation of the Installation of Solar Photovoltaic in Residential Houses in Malaysia: Past, Present and Future*, *Energy Policy*, (2011), Vol 39, issue (12), at pp. 7975 - 7987.

annual return, Malaysians might choose not to invest in the FiT since they have the options of investing in more lucrative and stable schemes.⁶⁸

It can be concluded that an investment in the FiT scheme in Malaysia would provide a better return compared to the positions in the UK and Germany. However, compared to other investment portfolios available in the country, the solar investment is not that lucrative at present. For that matter, would Malaysian households invest in this? Besides, according to the data in 2009, 60% of the Malaysia's population has a monthly average household income of less than RM 3,500.00.⁶⁹ Based on this, could Malaysians afford to finance the investment of the RM 47,800 for PV installation? The solution, perhaps, is for the banks and financial institutions to provide loans to assist households to finance the venture. The Ministry of Energy, Green Technology and Water estimates that by 2020, a minimum of RM 19 billion worth of loans will be generated for renewable projects.⁷⁰ There is no indication, however, whether this includes credits to households to invest in the Sun.

Table 3: Comparison of the solar investment with other investment portfolio in Malaysia⁷¹

Type of Investment	Average Yearly Dividend Yield (%)	Total Return On Investment (RM)	Average Annual Return on Investment (%)
Unit Trust – PITTIKAL	14.29	789,952.15	73.93
National Unit Trust – ASB	10.61	397,292.29	34.82
Employee Provident Fund	5.92	159,943.03	11.17
Government Bond	5.00	133,169.01	8.50
Fixed Deposit	3.00	88,922.08	4.10
Savings Account	0.95	58,298.94	1.05
Solar PV Installation in Malaysia		74,135.98	7.39

Another important factor to the success of the FiT policy is the awareness of the society on the need to shift to renewable energy such as solar power. In this

⁶⁸ *Ibid.*

⁶⁹ Economic Planning Unit 2010, Tenth Malaysia Plan 2011-2015 (2010), Chapter 4, at p. 3, available at : <http://www.epu.gov.my/html/themes/epu/html/RMKE10/img/pdf/en/chapt4.pdf>.

⁷⁰ *Supra* n. 3 at p. 24.

⁷¹ *Ibid.*

respect, it is interesting to note that the recent survey suggested that Malaysians, currently, have a low level of understanding on the numerous incentives available and are reluctant to invest in solar PV⁷². Another study conducted in 2009 concluded that only 11% of the interviewees have heard of PV. This is despite the fact that the same study shows that 83.8% of the urban Malaysian 'agreed that environmental problems can be reduced by using renewable energy.'⁷³ In short, generally, Malaysians are aware of the role of renewable energy to mitigate environmental problem but a greater part of the society have never heard of PV and their understanding of the incentives available to invest in PV is low.

Marc von der Forst has identified other barriers to the FiT's success in Malaysia. He conducted the survey with 23 people who have 'a clear relationship to the renewable energy sector in Malaysia, preferably PV.' They are the consultants, executive directors, CEOs, technical directors and journalists. Amongst other things, very interestingly, the findings are, that:⁷⁴ (a) the respondents named subsidies on fuels to have the highest restraining impact on the success of the FiT; (b) the attitude of the utility companies is the second biggest restraining impact – Tenaga Nasional Berhad, Sarawak Energy Berhad and Sabah Electricity have no interest in buying renewable powered electricity as they enjoy better profits from subsidised gas prices for power generation; and (c) many believe that Malaysia as a developing country is not capable of implementing the FiT system successfully.

CONCLUDING REMARKS

Malaysia has joined the 'FiTs club' of 50 other countries around the world. Would the households be rushing, as happened in Germany and the UK, to put solar panel on their roofs to take advantage of the FiT?

The pioneer nation of Germany in the gloomy and cloudy weather has been very successful. With the similar climate conditions, a newcomer, the UK is also doing well, so far. There is no reason, perhaps, for Malaysia, which is located at the Equator with the bright and sunny ambiance, not to make it. Interestingly, the initial response from the household and small scale non-residential applications was encouraging. The e-FiT online application system which was launched on the 2 December 2011 received immense response from

⁷² *Supra* n. 55.

⁷³ *Supra* n. 46 at p. 31.

⁷⁴ *Ibid* at p. 27, 28, and 33.

the public. This online application handles all submission and approval of FiT applications, as well as monitoring the progress of installation after the approval from SEDA. Two hours after the launching, the three-years quota for small scale non-residential solar PV was taken up. Within 24 hours, there were a total of 229 applications submitted, of which 201 applied for solar photovoltaic (PV) corresponding to 143.78MW. Specifically for installation of solar PV in residential houses, as of 17 February 2012, the quota for 2012 was already full, leaving only 5.12MW available for installation for 2013 and 2014. Assuming an average of 4kW per house, there will only be about 1,280 houses could apply for this scheme.

As mentioned earlier, however, there are other issues that need to be addressed by all the stakeholders. Environmental awareness is as important and has been identified as one of the pushing factors for the renewable energy market in Europe. More importantly, are the awareness and understanding of the FiT incentives. Other critical issues include trust in the FiT scheme, households' access to credit, the availability of skilled workers to install and maintain the solar panels, certification matters, the need to assess the existing rules and regulation on planning and building construction and taxation issues.

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